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BROOM CORN.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., May 6, 1903.

SIR: I have the honor to transmit herewith a paper on Broom Corn, and respectfully recommend that it be published as a Farmers' Bulletin. This paper was prepared by Mr. Charles P. Hartley, Assistant in Physiology, Plant-Breeding Laboratory, and was submitted by the Pathologist and Physiologist.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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BROOM CORN.

INTRODUCTION.

In comparison with many other farm crops of this country that of broom corn (*Sorghum vulgare*) is very small. The high prices, $150 to $170 per ton, that this product has occasionally commanded, have caused many a farmer to undertake its cultivation without first counting the cost of production and inquiring into the causes governing the price paid for the brush. The ease with which the crop can be grown to harvesting condition and the fact that a fair crop is a third of a ton per acre make the industry apparently lucrative, even at the ordinary price, which is about $80 per ton.

The sudden increases in acreage when the price is high show that growers, influenced by the apparent prospect of large profits, are induced to plant extensively to this crop. In 1881 Illinois grew 17,887 acres and the price was $128 per ton. The next year 43,036 acres were grown and the price was $80 per ton. The acreage and price then remained comparatively steady until 1891, when but 15,875 acres were planted and the price rose to $117 per ton, resulting the following year in the planting of 28,333 acres and a decline in price to $94 per ton. It is not to be inferred from this that the amount of broom corn grown is the only factor governing the price. The annual production is so small in comparison with that of the leading farm crops that the commodity offers an easy opportunity for speculation, which results in great fluctuation in prices. The marked decrease in price which follows when the acreage planted is unusually large is due in a great degree to overproduction, but also to the production of brush of an inferior quality. Growers who plant large fields without an adequate knowledge of the broom-corn business and a thorough preparation for taking care of the crop are sure to produce a poor quality of brush.

The object of this bulletin is to present to farmers who contemplate beginning the growing of broom corn some facts that need consideration in order that the attempt may not be a financial loss nor result in

placing on the market a poor quality of brush. It must be remembered that the business pays best when properly conducted and that the growing and marketing of good broom corn requires more careful attention and more implements than the growing of corn or wheat.

DESCRIPTION OF THE PLANT.

Broom corn belongs to the grass family and to the same species as do common sorghum, used for making sirup, and Kafir corn and Jerusalem corn, grown for forage and for grain. It differs from all other plants of the same species in having panicles or seed heads with much longer, straighter, and stronger branches or straws. This difference, wherein lies the value of the plant, has been produced by the selection of seed from plants possessing these characters to a great degree. It is for the seed heads, or "brush," as they are called, which are used in the manufacture of brooms, that the plant is cultivated.

GROUPS.

Broom corn is divided into two groups, known as standard and dwarf. The standard type grows to a height of 10 to 15 feet and produces brush from 18 to 28 inches long (fig. 1, *e*, *f*, and *g*). The brush of the standard type is used in making medium-sized and large-sized brooms, such as are known as carpet brooms and warehouse and stable brooms. Dwarf broom corn grows from 4 to 6 feet high, has a large amount of foliage, and produces a fine brush from 10 to 18 inches or more in length (fig. 1, *a*, *b*, *c*, and *d*), some strains producing brush as long as 2 feet, and this is used to some extent in making carpet brooms. For making large brooms dwarf broom corn is not as good as the standard, because the straws are weaker and less elastic, especially at a point near where they join the quill or extremity of the stalk. In fig. 1, *d*, showing a long head of dwarf broom corn, this weakness may be seen at the point *x*, as compared with the stronger, more elastic standard heads *e* and *f*. Although inferior to the standard for making carpet brooms, the dwarf broom corn is much better than the standard for making small hearth brooms, whisks, brooms for brushing clothes, etc. It is a mistake too often made for growers of dwarf broom corn to attempt to compete with growers of standard in length of brush. Dwarf broom corn well suited to the making of fine clothes brooms commands the highest prices on the market. For this purpose the straw should be fine, straight, tough, elastic, of a uniform green color without red tints, and from 10 to 12 inches long. With the dwarf form the head does not grow out free from the sheath of the upper leaf, but is inclosed in what is termed by growers the "boot" (fig. 1, *a* and *b*). Heads of standard broom corn are not thus inclosed, and this difference,

together with the difference in height of the plants of the two types, has led to different methods of harvesting, which will be referred to later.

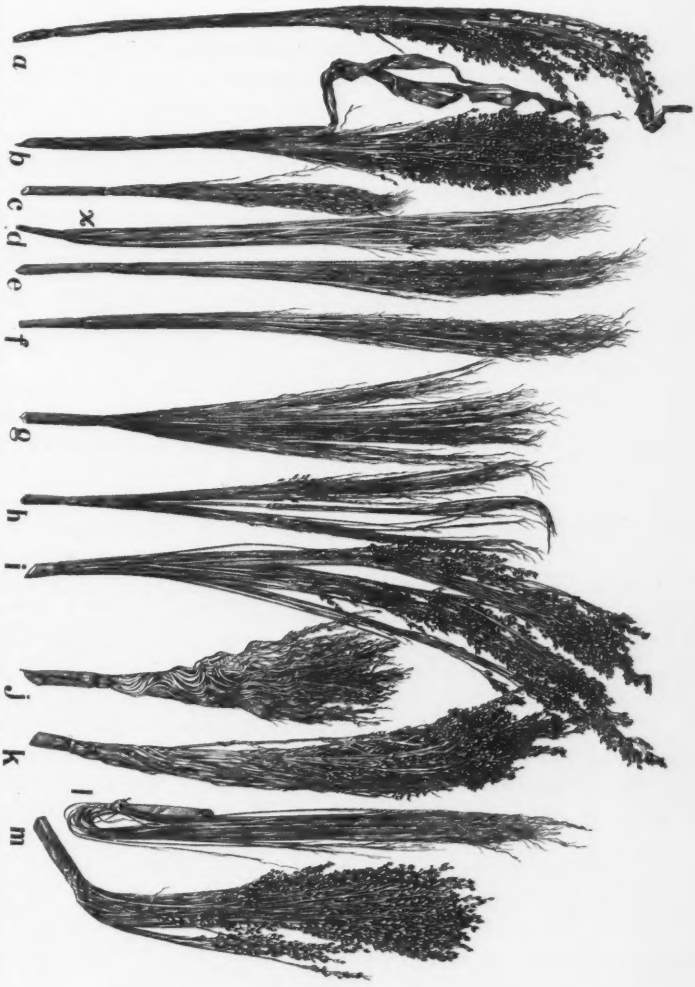

FIG. 1.—Poor and good seed heads of dwarf and standard broom corn: *a*, poor head of dwarf with large center; *b*, head of dwarf inclosed in "boot;" *c*, good grade of dwarf for whisks; *d*, long head of dwarf with characteristic weakness at point x; *e* and *f*, good grades of standard hurl; *g*, good head of self-working; *h*, poor grade of standard because of heavy center; *i*, *k*, and *m*, worthless smutted heads; *j*, worthless crinkly head; *l*, good grade of crooked. (One-seventh natural size.)

VARIETIES.

There are many varietal names used by sellers of broom-corn seed, but many of these are simply new names applied to old strains of broom corn and really do not represent varieties that have been sufficiently improved to deserve special designation. Such names are of

no assistance, and manufacturers in buying brush disregard varietal names and specify whether standard or dwarf is wanted and the desired length, color, and quality of the brush required for making the desired grade of broom. Some of the names that have been employed in selling broom-corn seed are: Tennessee Evergreen, Missouri Evergreen, Improved Evergreen, Wilson Evergreen, Chinese Evergreen, Early Long Brush Evergreen, Imperial Evergreen, Australian, California Golden, Black Spanish, Japanese, New Japanese, Dwarf, Little Dwarf, Mohawk, and Dwarf Emerald. However, it is not the name to which a purchaser of broom-corn seed should give his attention, but rather to the quality of the seed, and more especially to the quality of the brush from which the seed was selected.

LOCAL FACTORS GOVERNING THE GROWING OF BROOM CORN.

Climate and soil are the leading factors that determine whether broom corn can be profitably grown in any particular locality. The growing season will be found long enough in almost any part of the United States, since but from two to three months of good growing weather is all that is needed to produce a crop. Any soil that will produce a good crop of corn is sufficiently fertile for broom corn. For the best grades of fine, short, tough, dwarf broom corn light, sandy soils have been found preferable, richer soils having a tendency to produce coarser brush. For good crops of long standard brush a fertile soil is required, but river bottoms that are overflowed are unsatisfactory, because deposited weed seed will give trouble when the broom-corn plants are young and slow of growth.

Climate is perhaps a more potent factor than is the soil in determining where broom corn can be grown successfully. The plant is subtropical and does best in a warm, sunny climate where there is sufficient rain during the early part of the growing season to produce a strong, rapid growth. However, in order that the crop may be harvested at the proper time and in good condition and the brush dried rapidly so that it will retain its fresh, green color, it is necessary that warm, dry weather prevail at harvest time. Localities where frequent rains occur at the season when broom corn would be ready to harvest will not be found suited to this crop. Dry weather at harvest is desirable for many farm crops, but with broom corn it is essential to the production of a good quality of brush. Rain at the time the corn should be cut will cause much of the straw to become red, thus reducing its market value by about one-half; or rain upon the crop after it has been cut will cause it to bleach or lose its fresh, green color and take on a yellowish or dead color. Moreover, the harvesting of the crop requires so many men that it is essential to the profits of the business for the work to continue uninterruptedly, and this is impossible unless dry weather prevails at this season.

The above-described conditions of soil and climate are those that make the rich prairies of the Mississippi Valley suited for growing standard broom corn, and the lighter and drier soils of Kansas and Oklahoma adapted to the dwarf varieties. There are sections of the United States where broom corn is not now grown, but where the soil and climatic conditions are such that farmers with the proper equipment and knowledge of the business could produce large crops of brush of good quality. There are also sections that now produce small quantities of poor brush that could produce an excellent quality if the growers understood the proper methods of cultivation and treatment and the requirements of the market. Broom corn is a commodity of which the amount used is quite uniform from year to year, and of which this country grows more than sufficient to supply the domestic trade. The home market therefore does not require an increase in the quantity grown, but all manufacturers are desirous of an improvement in the quality.

GOOD SEED THE PRIME REQUISITE OF A GOOD CROP.

To one situated in a suitable section and desirous of engaging in broom-corn growing, the means of obtaining good seed for planting will be the first important consideration. Under no circumstances should seed taken from the scraper when a crop is harvested for brush be planted, for even should such seed germinate well, which is unlikely, it will prove unsatisfactory because of having been produced by plants possessing diverse characters, some of which are very undesirable.

Perhaps the best method to pursue in beginning the cultivation of this crop in a section where it has not been tried is to experiment the first season with small quantities of seed from the best-known sources. These different lots should be planted several rods apart to prevent their cross-pollination at blooming time, and the weak and undesirable stalks should be removed from the patches before the plants bloom. When in blossom all but the very best heads can be cut from the patches, and the different lots compared as to their desirable qualities. The superior plants remaining in the plat decided upon as having produced the best brush should be allowed to ripen their seed, and this can be used in planting a crop the next year.

While this is recommended as a good way for those unaccustomed to growing broom corn to begin its cultivation in a locality where it has not been tried, there is also a great opportunity for experienced broom-corn growers to greatly improve the quality of the brush produced by taking similar precautions regarding the selection of seed. Broom corn is a plant that can be very greatly improved by judicious breeding and, on the other hand, in many cases where it is grown

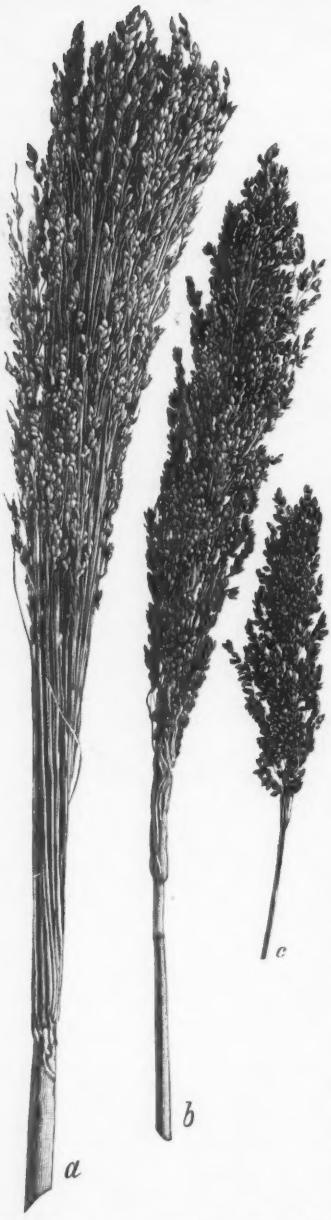

FIG. 2.—Broom corn, sorghum, and hybrid between the two: *a*, broom corn; *b*, hybrid; *c*, black-seeded sorghum.

extensively the crop suffers seriously from neglect in this regard. On some farms where Kafir corn is grown for grain and forage, or sorghum for sirup or forage, and where broom corn is grown for brush, the broom corn becomes so mixed and hybridized with the sorghum or Kafir corn that the value of the crop is greatly reduced. Fig. 2 shows three heads that were selected from a field of sorghum grown for forage by a farmer who also grows broom corn quite extensively. At the right is a head of black-seeded sorghum and at the left is a good head of broom corn, while in the middle is shown a hybrid between sorghum and broom corn, exhibiting intermediate characters of color and form. There were numerous other stalks in the field showing characters intermediate between sorghum and broom corn, some resembling to a greater extent the former and some the latter. It is the common verdict of those who have grown sorghum which has become mixed with broom corn that its quality for either sirup or forage is greatly impaired, while it is certain that broom-corn seed that has become mixed or hybridized with sorghum will not produce a good quality of brush.

Growers must bear in mind that a crop grown from seed produced by any particular seed head will be very much like that seed head. If it is a coarse seed head with a large central stem (fig. 1, *i*), many heads of this kind will be found in the resulting crop; but if all the seed planted be taken from heads with fine, straight, smooth straws,

the crop will be mostly of this nature. Of course it can not be said that there would not be a single coarse head in the crop, for the previous careless breeding and the inherent tendency of plants to vary would cause a few such individuals to appear, but it can be stated that the greater the number of years during which seed is planted from exceptionally fine heads only, the fewer will the poor individuals become, provided cross pollination with other varieties is prevented.

IMPORTANCE OF AN ISOLATED SEED PATCH.

It is certain that all growers of broom corn will find it much to their profit and to the improvement of their crops to grow each year, separated from other varieties of the species, a seed patch planted with seed from the very choicest individuals that can be selected from a similar seed patch grown the previous year. This will necessitate but very little more work than the unsatisfactory method of simply permitting a certain portion of the general crop to ripen for seed. The seed patch should be amply large to permit of the required amount of seed being selected without necessitating the choosing of any but heads of the best quality. This means that the patch should be large enough to produce many times as much seed as is wanted for planting purposes, for not one head in a dozen will possess all the good characters desired. All seed that is to be planted together in one field should be selected from stalks that ripen at the same time. If proper attention be given to this point from year to year the annoyance of having some stalks ready to be harvested while others are too young will be largely avoided.

QUANTITY OF SEED REQUIRED PER ACRE.

If the germination of the seed has been tested before planting, as should always be the case, and found to give a germination of 95 per cent or higher, 2 quarts of seed will be sufficient to plant an acre. Many growers find a bushel of good seed sufficient to sow 20 acres. In no case should seed that gives a lower germination than 90 per cent be planted, as it is sure to give an irregular stand and cause the plants that stand alone to produce coarse brush, while the crowded ones will be stunted and the uniformity of the crop impaired. Any grower can test his seed by means of two dinner plates and a piece of heavy flannel cloth. One hundred seeds are placed between the folds of the dampened cloth and placed in one plate and the other plate inverted over it, and the whole placed where the temperature will be from 60° to 80° in the daytime and not fall much below 50° at night. The good seeds will begin to sprout in three or four days and can be removed. If after ten days there are more than ten seeds out of the hundred

that have not germinated, the lot of seed from which the hundred were taken is unfit for planting.

Clean broom-corn seed of good quality weighs from 46 to 55 pounds per struck bushel. Seed sells from $2.50 to $4 per bushel, or from $4 to $9 per hundredweight, but unless a grower is well acquainted with the manner in which seed offered for sale has been grown he will be more certain of a good crop by growing his seed in accordance with the suggestions given than by purchasing it.

CHOICE OF FIELDS.

Farmers living in localities where broom corn is generally grown and who expect to continue in the business should construct drying sheds and supply themselves with the necessary seed scrapers, baling presses, etc., and make broom corn one of the annual crops in their system of crop rotation. The equipment necessary for conducting this business is too expensive to be used during an occasional year only, even if there were means of telling in what seasons broom corn would sell well. The safest way is to use only a portion of the farm for this crop and to hold the brush till the market permits of a profitable disposal. By using a goodly portion of the farm for other crops the holding of the broom corn for better prices will not be as burdensome as it often becomes when it is made the principal crop, as it is in some sections of Illinois, Kansas, Missouri, and Oklahoma.

The late planting of which this crop permits sometimes makes it desirable for replacing corn, oats, or other crops that for some reason or other have failed to start sufficiently well; but as a rule it should be early decided that broom corn is to have the fields best suited to its success. The field should be of the same character throughout so that the crop may be uniform in quality and in time of maturing, and thus admit of being harvested at the same time. If one side of the field be high and of light soil and another low with heavy soil, the crop will not all be ready to harvest at one time nor be of a uniform quality of brush. A foul piece of land should not be planted to broom corn, else a great amount of labor will be necessary to keep weeds from choking the young plants, which, although they take deep root the first two weeks, make but slow growth above ground. It is a good plan to plow and finely cultivate the soil two or three weeks before planting. This will cause many of the weed seeds to germinate, and then by means of a disk harrow or cultivator the weeds can be killed and the land prepared for planting. Such a cultivation before the seed is planted is of as much benefit as a cultivation given the growing plants.

PLANTING.

TIME OF PLANTING.

The date of planting must be governed by the climatic conditions of the locality in which the crop is grown, but it can be said that nowhere should planting be begun until the soil has become quite warm. Broom corn will not stand as early planting as indian corn, and if the seed be put in cold soil they will rot or germinate poorly, giving an irregular stand of weakly plants. The fact that this crop requires later planting than corn and many other farm crops is a consideration in favor of broom-corn growing, since it permits a more equal distribution of spring work. In localities having long growing seasons it may be desirable to plant so that the crop will be ready for harvesting at the season when dry weather is most likely to prevail. In California planting usually takes place from the middle of April to the middle of May, while in Oklahoma and Missouri it is done during May. In central Illinois, where standard broom corn is grown so extensively that three counties (Coles, Douglas, and Moultrie) sometimes produce one-half of the total crop of the United States, the planting season extends from the middle of May till the middle of June and harvesting lasts from the middle of August to the middle of September. Where the acreage is extensive it is best to plant various fields at intervals of a week or more, so that all the fields will not blossom at the same time and all can be harvested when in the proper condition.

METHODS OF PLANTING.

Standard broom corn should be planted in rows 3¼ to 3½ feet apart, while dwarf corn will give better yields if the rows are about 3 feet apart. The dwarf sort should also stand closer in the rows, about 6 or 8 plants to the foot. An Illinois grower of much experience gives 3 inches as the best distance apart in the row for the plants of standard broom corn. Drilling is the usual method, but sometimes, for convenience in hoeing, it is thought best to plant in hills. When this method is employed, 16 to 18 inches is a good distance between hills, with 5 or 6 stalks of standard or 8 to 10 of dwarf corn to the hill. On poor soil a thinner stand is required than on richer soil.

Almost all corn planters can be arranged to plant broom-corn seed. If there are no plates with sufficiently small holes, the holes of the plates used for planting corn can be run full of melted lead and then bored of the desired size. Too often the mistake is made of planting too much seed, and this often comes about by reasoning that it is better to plant a little too much than not quite enough, for if too thick the plants can be thinned. It is true the superfluous plants could be properly removed, but as a matter of fact they very seldom are. Thinning

out plants of this nature is a tedious task and requires more time than to plant the field a second time. It is thus best to plant exactly the proper quantity of good seed; then should any unusual circumstances produce a poor stand the field should be cultivated and harrowed and planted again. No pains should be spared to get an even stand of plants, for otherwise the crop will not be of uniform quality.

It is hardly necessary to state that before planting the soil must be brought to a finely cultivated condition, for growers know that this is advisable with all crops; but it is especially true of broom corn because of the slow-growing habit of the young plants. If the land is rough and cloddy, early cultivation can not be accomplished without covering the plants. For the same reason listing or planting in deep furrows is not satisfactory. On heavy clay soil the seed should be planted one-half inch deep, but on very sandy soils or light soils containing much vegetable mold an inch will not be too deep. If dry, the soil should be rolled after planting.

CULTIVATING.

Cultivation must be commenced early and repeated frequently to prevent weeds from getting the start of the slow-growing young plants. As hoeing and hand weeding are too expensive, large weeders, harrows, and very narrow-shoveled cultivators with fenders to keep the soil off the plants are employed until the plants attain a height of about a foot, after which they grow rapidly and will thrive with the same cultivation as does Indian corn. Many find it advisable to harrow lengthwise with the rows with a sharp-toothed harrow just as the plants are coming up. With a wide harrow and plenty of horsepower this operation is quickly accomplished. Old stalks and other trash should never be left on the surface of a field planted to broom corn, or it will seriously interfere with the early cultivation of the crop. Level culture is most satisfactory from the beginning till the crop is laid by, and will leave the field in good condition for harvesting. Cultivations should be frequent enough to keep the soil from becoming crusted and hard, for in this condition the moisture passes off most quickly, leaving the soil dry and the soluble salts or plant food at the surface and entirely out of reach of the roots of the plants. An inch or two of finely divided soil or dust serves as a thick blanket in conserving the moisture and keeping the dissolved plant food accessible to the roots.

HARVESTING.

TIME TO HARVEST.

In most States broom-corn harvest comes at a time when it does not conflict with work on the principal field crops. It comes after oat and wheat harvest is finished and before corn is ripe. The present market

demands brush of a good, green color, and to obtain this the crop must be gathered when in bloom or when the anthers are falling from the heads. In this condition the seeds are of course undeveloped and are therefore of little value except as fertilizer. In some sections, notably California, the seed is allowed to ripen before the crop is harvested, about a ton of seed per acre thus being obtained, which is used as feed for hogs and poultry, or it is ground into meal and used as a breadstuff for making griddle cakes. When the crop is allowed to ripen the brush sells for a very low price, and this practice can not be recommended. In California home-grown brush sells for $35 to $95 per ton, while the same market quotes eastern-grown brush at $125 per ton. If the crop is grown for brush, it should be harvested at a time when it is of the best quality. If grain is what is wanted, much better crops can be obtained by growing Kafir corn,[a] another variety of this species that has been improved for seed and forage production. If forage is the product desired, sorghum[b] will give better returns. Kafir corn, sorghum, and broom corn being closely related plants, that have been developed along different lines for different purposes, illustrate how susceptible of modification is this species. It is likely that before long plant breeders will be able to produce a variety that will yield good brush for brooms as well as stalks rich in sugar for making sirup.

DWARF AND STANDARD VARIETIES.

The method employed in harvesting dwarf broom corn is quite different from that used in the case of standard. Because the dwarf plant is but 4 to 6 feet in height and the head is partly inclosed in the sheath of the upper leaf, it is found more convenient to pull the heads than to cut them and then remove the "boot." In some parts of Oklahoma and in some other sections the pulling of dwarf broom corn is accomplished by going through the field two or three times, each time pulling the heads that are sufficiently advanced and piling them on the ground and shading the piles with stalks or blades. This practice can be followed only in sections where dry weather prevails at harvest time, and even in such sections it is not the most satisfactory. By making sure of an even stand of plants and by yearly selecting seed from plants that have ripened at the same time, crops can be produced with plants so uniform that the entire field may be pulled at one operation and loaded directly upon wagons. This lessens the amount of harvest work and increases the possibility of producing brush of good and uniform quality.

Because of the partial inclosure of the heads within the "boot" the dwarf sort is more subject to injury from rains at harvest time than the

[a] Farmers' Bulletin 37, U. S. Department of Agriculture.
[b] Farmers' Bulletin 50, U. S. Department of Agriculture.

standard. Water collects in the "boot" around the head and causes it to redden, which reduces the value of the crop by about one-half. If weather conditions are favorable, dwarf broom corn can be harvested in first-class condition and with less labor per acre than can standard, but doubtless the greater yields of the latter make it as easy to bend down the tall stalks and cut a ton of brush from 3 acres as it is to pull a ton of dwarf corn from 5 acres, these being the averages, respectively, of the two kinds required to produce a ton of brush.

TABLING.

The greater height of the standard broom corn has made necessary some method of bringing the heads down within easy reach for cutting, and the system of tabling is universally used because of its convenience and because the brush is thereby kept clean and dry after it is cut. Tabling consists in bending at a height of 2½ or 3 feet the stalks of two adjacent rows diagonally across the intervening space so

FIG. 3.—Field of standard broom corn in Illinois, tabled and cut, ready for hauling.

that the portion of the stalks above the sharp bend is supported in a horizontal position, with the seed heads of one row extending about 2 feet beyond the opposite row. The operator walks backward, bending a few stalks first from one row and then from the other, thus forming a self-supporting "table" from every 2 rows (fig. 3), and bringing the seed heads into a convenient position for cutting. One man can table as fast as two can cut, the three doing about 2 acres per day.

CUTTING.

In cutting the operator passes along the spaces between the tables and with a knife similar to a shoe knife cuts the heads 6 to 8 inches below the attachment of the straws. As this portion of the stalk is often surrounded by the leaf sheath it becomes a matter of much importance for cutters to learn to cut through the stalks but not quite

through the sheath, so that the latter will remain attached and not be lifted away with the head. Cutters wear a leather stall on the right forefinger, and grasping the stalks between the forefinger and the knife blade they cut the stalk by pressure of the thumb upon the back of the blade. While 8 inches is the length custom has established for cutting the stems below the attachment of the straws, some growers, either ignorantly or for the purpose of making their yields weigh heavier, cut the stems much too long, thereby reducing the value of their crops. Six inches of stem is sufficient to meet all of the requirements of the manufacturer, and thus, with a minimum of waste, the brush will command a higher price per pound.

The brush as cut is laid by handfuls upon every second table (fig. 3), being so placed that the top end of all the piles on any two tables will point toward the empty table between. By thus placing the brush from four rows upon every alternate table wagons can be driven over the empty tables on either side.

HAULING.

In hauling the brush from the field to the scraper, wagons are driven over the empty tables and a man on either side takes up the piles of cut brush, with tops toward him, turns and places them on the rack in such a manner that the load is formed of a double row of seed heads, having the stems lapping in the middle to bind on the load.

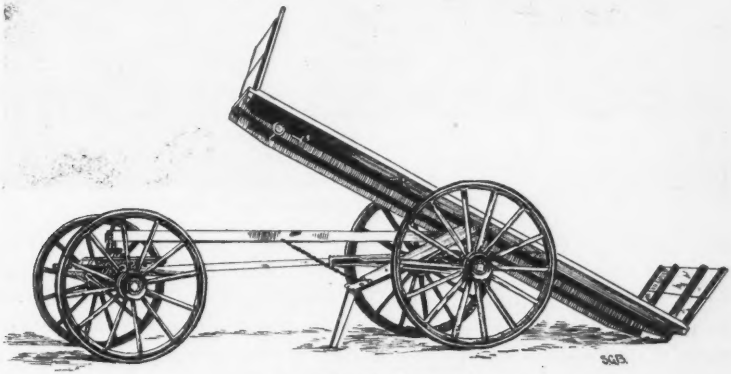

FIG. 4.—Broom corn dump rack.

Dump racks (fig. 4) are quite essential to the broom-corn business. They reduce to a minimum the work of unloading, being so arranged that by dropping a lever to the ground and driving forward the bed is shoved back till the rear end drops to the ground and allows the brush to slip off in an even pile just as it was on the rack (fig. 5).

SORTING.

Those who have grown broom corn for many years know the necessity of separating the crooked brush from the straight, as a few crooked heads will lower the market price of an entire bale. This sorting can best be done in the field while the brush is in small piles on the tables, where such crooked heads can be easily distinguished and separated. Crooked brush sells for about half the price of straight brush, is much harder to handle, and can not be so neatly baled, so that a grower is fortunate if his crop contains but little crooked brush (fig. 1, *k*, *l*, and *m*). Almost all fields contain a small per cent of heads that are so coarse, with thick, heavy central stalks (fig. 1, *a* and *i*), or so snarly (fig. 1, *j*), as to be of no value, and these should not be gathered. The

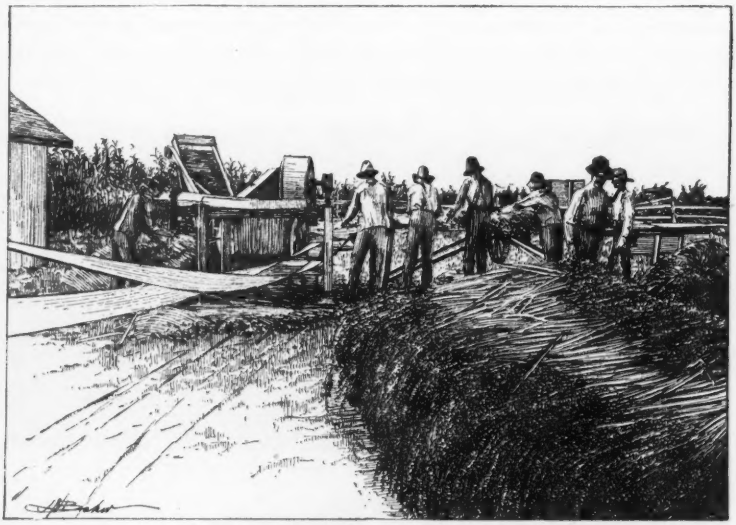

FIG. 5.—Thrashing or cleaning broom corn in Illinois.

per cent of such heads can be greatly reduced by planting seed from superior heads only. If harvest is delayed a few days many heads that would have been straight if cut at the proper time will become crooked by the weight of the forming seeds or by the weight of water that will hang to the heads in heavy drops during wet weather. As rain injures the quality, the cut brush should be hauled to the scraper, seeded, and put in sheds as soon as possible after being cut.

Since no less than twelve men can advantageously thrash broom corn and place it in the sheds, most growers do not keep a sufficient force to table, cut, and haul at the same time the thrashing is in progress. Consequently many adopt the practice of working the force in the field the greater portion of the day, and in the evening thrashing and putting away to dry what has been cut during the day.

THRASHING.

The removing of the seeds from the brush is variously termed seeding, scraping, or thrashing. This is accomplished by bringing the heads in contact with a rapidly revolving cylinder the surface of which is set with teeth or spikes. A thrasher (fig. 6) of the kind now in general use in sections growing much broom corn, costs from $150 to $200. Such a machine, with eighteen to twenty men to keep it running steadily, can clean the brush from 30 to 40 acres in a day. The seed heads are not drawn entirely through between the cylinders as in thrashing grain, but are held firmly and evenly by means of a toothed belt which carries an even stream of brush in front of and at an angle with the cylinders, so that, beginning at the top portion, the seed is removed as the heads are carried farther and farther between the cylinders. With all the seed removed the belt deposits the brush on a

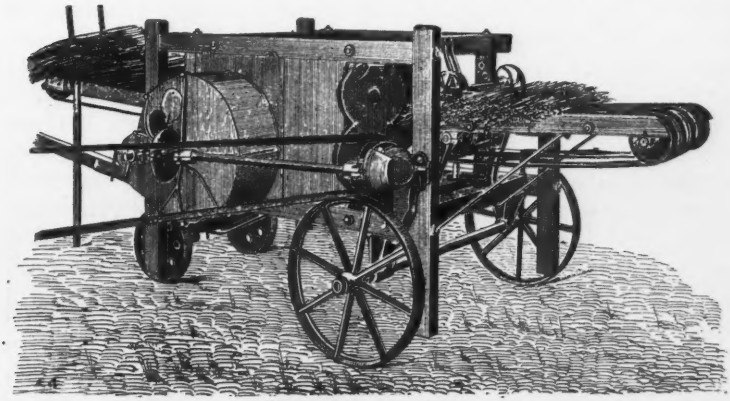

FIG. 6.—Broom corn cleaner.

table at the other end of the cylinders. The feeding of the seed heads to the thrasher and the removal of the cleaned brush and storing it in the drying sheds, requires a force of twelve to fifteen men (fig. 5).

In some sections crews with thrashing machinery travel from farm to farm and thrash the crop for $2.50 or $3 per acre, but to depend upon these is unsatisfactory because of the difficulty of getting a crop thrashed at the proper time. Growers should see that the seed is all removed from the heads, or manufacturers will be justified in reducing the price, as they can not be expected to pay 5 cents per pound for material which they can not use.

DRYING.

That the brush may retain a fresh green color after drying, it is necessary that it be dried rapidly and not exposed to strong light while drying. To meet these requirements broom corn is ordinarily

dried in sheds. During the broom-corn season these sheds are used expressly for drying the crop, but during the remainder of the year they can be used for storing corn fodder or farm implements, or for various other purposes. A shed 48 feet long, 16 feet wide, and 10 feet to the eaves will usually furnish sufficient room for drying the crop from 40 acres. If there is an interval of three or four weeks between the harvesting of one 40 acres and a later 40 acres, the brush from the first can be bulked or baled and the same shed used for the second.

Understanding the requirements, most farmers will be ingenious enough to construct very convenient drying sheds. The main requisites are a dry location, a good roof, with eaves extending some distance beyond the sides, and good ventilation throughout. A common method of construction is to place uprights, 8 feet apart in each direction, and nail to these, 4 inches apart, strips 1¼ inches wide, reaching across the shed. For a shed 48 feet long this plan gives six transverse sections, each 8 feet wide, with ends open for free circulation of air. Slats, 2 inches wide and 8 feet long, are required in large numbers, but are not put in place until the filling of the shed with brush is begun. For a shed of the size mentioned above 2,200 such slats are needed. Beginning at the bottom a shelf is formed by placing two of these movable slats across a section, resting their ends in the lowest spaces between the transverse strips nailed to the uprights. The brush is then evenly spread 2 or 3 inches deep upon these two slats, and then another shelf is made 4 inches above the first, and so on, till the shed is filled. If placed more than 3 inches deep the brush will not dry quickly and well, and may become musty or "shed burned."

BULKING.

In the shed the crop is safe from injury by rain, although warm, dry weather is desirable to cause it to dry rapidly. Just as soon as dry, so that the stems seem to contain no moisture when squeezed or twisted, the brush should be taken from the slats and piled in straight, compact tiers. In dry weather from two to four weeks will be sufficient to dry the broom corn for bulking, which should be done as soon as it is dry in order to prevent bleaching.

BALING.

This process consists in pressing the brush into compact bales and binding with wire. It is very important that it be well and neatly done, for to some extent the appearance of the bales determines their market value. Fig. 7 shows a bale of Illinois broom corn that reached a Washington factory in good shape. At a meeting held in Chicago on February 18, 1902, the Broom Manufacturers' Association of the

United States and Canada unanimously adopted a resolution binding themselves "not to purchase any broom corn of the crop of 1902 or thereafter which is not properly cleaned, seeded, and baled." Baling can be done at any time after the brush has become thoroughly dry, but as long as it is the least damp or "in the sweat" it should remain bulked. Manufacturers frequently open bales that have become moldy after baling which would have been good stock had the baling been delayed till the brush became thoroughly dry. Baling is accomplished usually by a horsepower press. Such a press is shown in fig. 8, while fig. 9 shows one in use where the wire is being tightened preparatory

FIG. 7.—Rather poorly seeded but well baled Illinois brush, as seen in an eastern factory.

to removing the bale from the press. The five spaces at top, bottom, and sides are for the purpose of passing the wire around the bale while it is under great pressure. Rather large wire, No. 9, is used; finer wire cuts into the brush. The bales are 45 inches long and 26 inches thick, the depth depending somewhat upon the degree to which the press is filled. As found on the market the bales are usually about as deep as long and vary in weight from 300 to 400 pounds, averaging about 340 pounds.

In opening bales manufacturers sometimes disclose various dishonest methods practiced to increase the weight of the bales. Putting broom-

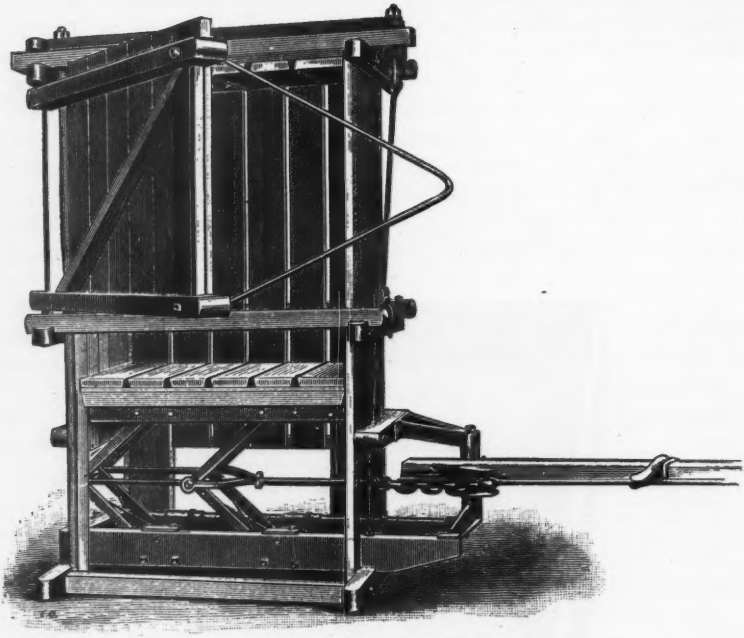

FIG. 8.—A horsepower press.

FIG. 9.—A horsepower press in use.

corn seed or heavy objects in the press as it is being filled, or pouring heavy brine into the bales are the means most often employed. Such fraudulent practices cause manufacturers to hesitate to buy from any but growers of known reliability.

From six to eight men can work together to advantage, and with a horsepower baler can bale 10 tons or 60 bales per day. Where the press is drawn from farm to farm two men usually go with it and charge about 60 cents per ton for the machine and one man, and $1.50 per day for the other man.

MARKETING.

The following quotations of grades and prices from two leading broom-corn centers of the United States will give a good idea of the requirements of the market, and show that with this crop as with many others, it will pay to produce the best quality possible:

	Per ton.
Common, partly off color, red-stained and bleached, self-working	$50
Fair grade, slightly off color, self-working	60
Good color and good fiber, self-working	$75 to 80
Fine fiber, dwarf, red tipped	80
Fine fiber, dwarf, running well for whisk brooms	100
	Cents per pound.
Fair, crooked	1½
Good, well-handled, crooked	2
Fair, medium, red-tipped	3½
Slightly tipped, smooth growth	4
Good, green, smooth, self-working	4½
Choice, green, self-working, carpet stock	5
Fair, medium, sound hurl	3½
Good, medium hurl	4
Good, green, smooth, carpet hurl	5
Choice, green, smooth, carpet hurl	5½

A communication addressed to a number of broom manufacturers asking in what respects their needs could be better supplied by broom-corn growers to make possible the paying of better prices met with answers which can be expressed thus: By furnishing good bales of standard grades of brush so that manufacturers can buy what they want without being compelled to take much that they do not want.

Broom-corn growers should learn what grade of corn brings the highest price, and strive to produce that grade. If but a portion of the crop comes up to the market requirements for a particular grade, it should be baled separately. A closer acquaintance of grower and manufacturer is greatly needed, for without such the middleman will receive as large profits as the grower or the manufacturer. A farmer who grows a considerable quantity of brush should have no difficulty in finding a manufacturer who will agree to buy each year all of the brush of a given grade that can be produced. Some manufacturers

have expressed the belief that it would be well for every producer to attach his brand or name and address to each bale that leaves his farm. This would enable the grower who produces a good quality of brush to acquire a reputation and establish a demand for his own product.

Any grower of broom corn, unless he makes his crop into brooms or sells to a local factory, will find it troublesome to dispose of a small supply. While the great fluctuations of broom-corn prices make it unwise to plant the greater portion of the farm to this crop, it is nevertheless true that the man who produces broom corn in large quantities can do the work to better advantage and more readily dispose of his crop.

PROFITS.

The profits depend to so great a degree upon the management of the work and the price of labor that it is hardly possible to give exact estimates of the cost of production that would be applicable to any great portion of the United States. Estimates from experienced growers in Illinois and Kansas place the cost of producing broom corn ready for market, including rent of land, at from $35 to $50 per ton. In Illinois 3 acres are required to produce this amount of standard broom corn, and in Kansas 5 acres will generally produce a ton of dwarf broom corn. The average value of dwarf and standard broom corn is about the same, but when short and fine, and suitable for fine small brooms, the dwarf brings the better price. If cut immediately after the brush is harvested the fodder of the dwarf broom corn is equal to that of Indian corn, but the standard is little valued as fodder. One Illinois grower states that there is the same profit in broom corn at $75 per ton as in Indian corn at 30 cents per bushel. The average price per ton from 1877 to 1901, as given in the Statistical Report of the Illinois Board of Agriculture for December, 1901, is $79.89.

The great risk of loss because of bad weather and the extra care necessary to harvest a crop naturally make broom-corn growing less desirable than corn growing, unless a greater profit can be derived. The difficulty in getting reliable help at the time the crop must be harvested has caused many to discontinue broom-corn growing, and others have given up the business because of the hard work forced upon all members of the family by the presence during harvest of so many laborers, some of whom, especially in certain sections, are not desirable characters to have about the home.

DISEASES AND INSECT ENEMIES.

The most troublesome disease of broom corn is a smut (*Sphacelotheca sorghi*), which in some sections does much damage. The disease shows in the seed head, where in place of good seeds are prolonged conical spore cases filled with spores which appear as black

dust or smut. Fig. 10, *a* and *b*, shows sprigs from smutty heads, and *c* a seed-bearing sprig from a healthy head. This disease is transmitted from one year's crop to that of the next through the seed.

FIG. 10.—Broom-corn smut and seeds: *a* and *b*, diseased sprigs from different heads; *c*, healthy seed-bearing sprig; *d*, healthy seeds. (Twice natural size.)

The spores germinate when the seeds germinate, and the smut grows in the stalk of the host plant and forms its spores where a healthy plant would have formed its seeds. Smutted heads are usually of a very poor quality, and the black smut from them collects upon the

good heads and injures their appearance, besides making the thrashing of the crop a disagreeable task. Badly infected heads are shown in fig. 1, *i* and *k*. The Illinois Experiment Station has demonstrated that this disease can be controlled by soaking the seed for fifteen minutes in water heated to 135° F.[a] Farmers' Bulletin No. 75, U. S. Department of Agriculture, describes fully the hot-water treatment for grain smuts.

An aphid or plant louse, which multiplies rapidly and is often found in great numbers in the seed heads and under the sheaths of the leaves, and the chinch bug, are the most injurious insect enemies of broom corn. Thorough plowing and cultivating and crop rotation will usually prevent the aphids from doing much damage. Farmers' Bulletin No. 132, U. S. Department of Agriculture, gives various means of combating the chinch bug.

Other insects feed on the leaves, roots, and other parts of the plant, and occasionally appear in injurious numbers. Prompt advice by correspondence regarding insect pests will always be given by the Chief of the Division of Entomology of this Department upon request.

STATISTICS.[b]

In 1899 there were 178,584 acres in the United States devoted to broom corn, producing 90,947,370 pounds, or an average of 509 pounds per acre. The total value of this crop was $3,588,414, averaging 4 cents per pound and $20.09 for each acre grown.

In 1889 there were grown in the United States 93,425 acres of broom corn, producing 39,557,429 pounds.

Following is the percentage of the total yield for 1879, 1889, and 1899 of the leading broom-corn States in order of production:

In 1879 broom corn was grown in 30 States and Territories, Illinois, Kansas, Missouri, New York, Nebraska, Ohio, and Iowa producing more than 1,000,000 pounds each, and their combined production equaling 94 per cent of the total crop.

In 1889 broom corn was grown in 39 States and Territories, only four—Illinois, Kansas, Nebraska, and Missouri—producing more than 1,000,000 pounds each, their combined production equaling 89 per cent of the total crop.

In 1899 broom corn was grown in 40 States and Territories, Illinois, Kansas, Missouri, Oklahoma, Nebraska, Texas, Iowa, California, and Tennessee producing more than 1,000,000 pounds each, their combined production being 96 per cent of the total crop. Of these, California gives the greatest production per acre, 686 pounds, and Oklahoma the least, 276 pounds.

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[a] Bull. 47, Illinois Experiment Station, 1897. Broom-Corn Smut.

[b] Twelfth Census of the United States, Vol. VI, Part II.

Acreage and production for the years 1889 and 1899 of all States and Territories growing more than 100 acres of broom corn.

State or Territory.	Acres.		Pounds.	
	1899.	1889.	1899.	1889.
Alabama	152	61	56,290	25,698
Arkansas	879	135	304,690	52,701
California	1,669	815	1,146,000	611,975
Colorado	1,241	301	226,550	60,165
Florida	34	171	3,390	196,820
Illinois	95,137	34,340	60,665,520	15,932,502
Indiana	815	413	384,170	157,231
Indian Territory	397	.....	147,020	.....
Iowa	2,220	1,108	1,178,130	567,072
Kansas	34,383	30,717	11,813,310	10,809,434
Kentucky	839	195	384,550	93,063
Louisiana	107	24	41,120	11,420
Minnesota	149	80	76,960	42,090
Mississippi	214	41	143,750	24,776
Missouri	10,219	2,618	3,693,370	1,051,139
Nebraska	6,627	16,792	2,733,290	6,514,763
New Mexico	14	102	5,800	24,500
New York	356	993	201,060	450,380
Ohio	802	1,574	537,160	801,957
Oklahoma	12,366	59	3,418,490	16,550
Pennsylvania	221	57	114,610	36,319
South Dakota	239	237	100,570	117,200
Tennessee	3,444	1,439	1,015,460	409,436
Texas	3,743	596	1,638,150	315,741
Virginia	1,762	140	663,390	43,159
Wisconsin	64	157	38,850	92,468

CONCLUSIONS.

Broom corn is a hardy plant and stands dry weather well, but makes slow growth during the first three weeks after planting and needs clean fields and thorough, early cultivation.

One contemplating broom-corn growing in an untried region should first ascertain by experimentation whether a good quality of brush can be produced and what kind of broom corn is best adapted to the locality.

Without good seed good crops can not be grown, and growers should improve the qualities of their crops from year to year by careful seed selection.

In well-adapted regions there is a good profit in growing broom corn, and the secret of success lies in the knowledge the grower possesses of the best grades of brush, how to produce the best grade, and how to dispose of it. Growers should become acquainted with broom manufacturers and the quality of brush they prefer, and arrange to sell directly to them as far as possible. To secure the greatest profits the business must be conducted in the best and most economical manner and quite extensively, but it will seldom be advisable for a farmer depending upon the products of his farm to plant more than a quarter of it to broom corn, especially if the crop is to be sold in open market.

For properly conducting the business on an extensive scale the necessary sheds and slats, thrasher, press, dump racks, etc., will cost from $700 to $1,000. Once having obtained this equipment broom corn should be grown yearly without regard to the market price at

planting time. Reports regarding the available supply of broom corn or its future prices are largely guesses often circulated to produce some desired impression on the broom-corn market and should never affect the acreage planted nor persuade a grower to sell good brush for less than the cost of production plus a fair profit.

While it is probable that some growers will find it to their advantage to establish on their farms broom factories, where the extra men needed during harvest time may find employment during winter, it is not likely that any farmer will find it profitable to grow a small patch of broom corn for the sole purpose of furnishing brooms for the use of his family. The price of the few brooms a family needs in a year is less than the value of the time required to grow the brush and make it into brooms. The making of a few brooms can be accomplished without much machinery, but a farmer who gives proper care to the leading farm operations can not afford the time necessary to care for a small amount of broom corn.

A ton of broom corn makes about 100 dozen brooms of ordinary size. The poorest brush is used for the central portion of the broom and is called under-working; about this is placed a better quality known as self-working, and this in turn is covered with the best quality, known as hurl.

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The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to any Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. The missing numbers have been discontinued, being superseded by later bulletins.

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